THIRD STREET / ROUTE 15 OVER BUFFALO CREEK
TOWN OF FARMVILLE, VA
PRELIMINARY H&HA
HSMM COMMISSION NUMBER: 30100M

Narrative

ADDENDUM #1

A. Changes to Page 2, Paragraph 3

EXISTING CONDITIONS

This project is located in the Town of Farmville, Virginia. Currently Third Street / Route 15 crosses Buffalo Creek with a four-lane 228 ft long bridge with sloping abutments and six concrete piers. VDOT is preparing preliminary plans for replacing the existing seven span bridge with a 272' 4" long, three span bridge. The proposed layout of the bridge analyzed in this study is included in Exhibit 6. The bridge has 1:1 sloping abutments, spans of 88'8", 95'0", and 88'8", and solid, round nose piers with a width of 2'6". Buffalo Creek is a FEMA studied stream; the HEC-2 backup data was obtained from FEMA.

The FEMA study was performed using the National Geodetic Vertical Datum of 1929 (NGVD 29). Therefore all elevations reported in this study are in NGVD 29 unless otherwise noted. The VDOT survey is referenced to the North American Vertical Datum of 1988 (NAVD 88). There is a 0.9 ft difference between NGVD 29 and NAVD 88 (i.e. 300 (NAVD 88) = 300.9 (NGVD 29)).

The topography of the area is generally flat. Just upstream of the Third Street crossing Buffalo Creek bends approximately 90º and parallels the road. Also upstream of the crossing is the confluence of Buffalo Creek and Little Buffalo Creek. Wilcks Lake is located upstream of the crossing between Buffalo Creek and Third Street. Third Street is relatively flat to the left of the bridge and slopes up to the right of the bridge (looking downstream). There is a railroad downstream of the crossing that approximately parallels Third Street. The railroad fill is high enough (FEMA Reference Mark 5 – 333.067) that it does not get overtopped during the 500-yr flood. Therefore, the railroad fill and bridge create a significant restriction resulting in backwater at the Third Street Bridge. Downstream of the railroad, Buffalo Creek meanders into the Appomattox River. Third Street / Route 15 is approximately 13 ft above Buffalo Creek at normal flow.

HYDROLOGIC DATA

The watershed was delineated on a USGS Topographic Map. The area of 116.71 sq. miles reported in FEMA's Flood Insurance Study was verified with the USGS topographic map. The 10, 50, 100, and 500-yr discharges published in the FEMA Flood Insurance Study were used in this study. The 2, 5, and 25-yr discharges were calculated from discharges in the Flood Insurance Study. The Ordinary High Water discharge was calculated using the VDOT formula:

OHW (cfs) = 1.1 x Drainage Area (mi^2)

HYDRAULIC MODELING

A 272' 4" long bridge will replace the 228 ft long existing structure. The proposed structure will not significantly increase the 100-year flood elevation at any point along Buffalo Creek. The low chord of the proposed bridge is at elevation 308.08; the low chord of the existing bridge is at elevation 309.55.

The FEMA Effective Model does not consider backwater effects from the Appomattox River. The backwater is taken into account when FEMA created the FIRM panel and flood profiles, but FEMA's effective model uses a starting slope of 0.002 ft/ft rather than flood elevations on the Appomattox River. The Adjusted Existing Conditions Model and Proposed Conditions Model were run without backwater from the Appomattox River using a starting slope of 0.002 ft/ft. These models were also run with backwater effects from the Appomattox River. Because the ratio of the drainage areas is closer to 1:1 than 10:1 (Appomattox River – 186 sq. mi., Buffalo Creek – 116.71, Ratio = 1.6:1), the same magnitude storm was used on both water bodies. Tables are included in this report containing the results from both analyses. The models with backwater from the Appomattox River produced flood elevations approximately 2.5 ft higher than without backwater from the river.

The ~~5-yr~~ 2-yr storm will safely pass through the proposed bridge with at least 1 foot of freeboard assuming no backwater from the Appomattox River. Therefore, the design storm for the proposed bridge is the ~~5-yr~~ 2-yr storm (Exceedence Probability = ~~20%~~50%).

The following is a description of each modeling step:

Existing Conditions Model (Duplicate Effective Model) – This model is a duplicate of the hard copy of the HEC-2 data provided by FEMA. This model represents the conditions at the existing bridge crossing of Third Street / Route 15 over Buffalo Creek. The results closely match the results on the hard copy as shown below:

SECNO	Effective Model	Duplicate Effective	Difference	Comment
	1% Flood	1% Flood		
25.9	302.40	302.40	0.00	
34.6	305.42	305.43	0.01	Insignificant Difference
35.14	307.69	307.69	0.00	
35.15	312.99	312.99	0.00	
35.36	312.02	312.03	0.01	Insignificant Difference
35.37	312.63	312.62	-0.01	Insignificant Difference
35.9	314.60	314.59	-0.01	Insignificant Difference
40.05	314.59	314.58	-0.01	Insignificant Difference
41.47	314.73	314.72	-0.01	Insignificant Difference
41.48	314.73	314.72	-0.01	Insignificant Difference
41.92	314.73	314.72	-0.01	Insignificant Difference
41.93	314.78	314.76	-0.02	Insignificant Difference
44.7	314.81	314.80	-0.01	Insignificant Difference
67.85	315.05	315.04	-0.01	Insignificant Difference
89.1	315.21	315.20	-0.01	Insignificant Difference
118.7	315.97	315.94	-0.03	Insignificant Difference

There are several sections where the ground line is not extended up far enough to intersect the 100-yr (1%) flood elevation. It appears that this was done intentionally by the original modeler. The floodplain is very wide and flat and the cross sections were likely ended at the extent of the effective flow. The cross sections were not extended in this study because it is assumed that the area beyond the limits of the original cross sections is ineffective flow area.

Adjusted Existing Conditions Model (Corrected Effective Model) – The Existing Conditions Model was revised by adjusting natural ground cross sections just upstream and downstream of the bridge in order to facilitate modeling the proposed bridge. The following changes were made:

- FEMA section 41.47 was moved downstream 9 feet and renamed 41.38 in order to accommodate the wider proposed bridge to be added in the Proposed Conditions Model. The channel geometry was also revised using the VDOT Survey Centerline Profile so it would match the channel geometry in the Proposed Condition Model.
- FEMA sections 41.48 and 41.92 were revised using the channel geometry from the VDOT Survey Centerline Profile so they would match the channel geometry in the Proposed Conditions Model.
- FEMA section 41.93 was moved upstream 4 feet and renamed 41.97 in order to accommodate the wider proposed bridge to be added in the Proposed Conditions Model. The channel geometry was also revised using the VDOT Survey Centerline Profile so it would match the channel geometry in the Proposed Condition Model.

The only survey cross section supplied by VDOT which was used was the roadway Centerline Profile. The cross sections upstream of the bridge (VDOT survey sections103+00, 105+50, and 110+00) were not used because the stream bends just upstream of the bridge. Therefore, the cross sections ran parallel to the stream rather than across the floodplain, perpendicular to the flow of floodwaters. The VDOT survey cross sections downstream of the bridge were not used for the following reasons:

- 90+00 – This cross section is located between cross sections 25.9 and 34.6 in the FEMA model. The survey cross section was used to verify that the FEMA cross sections adequately represent the channel and floodplain.
- 95+00 – This cross section is just upstream of the railroad bridge and extends onto the railroad fill. The railroad bridge is modeled as a normal bridge in the FEMA Model.
- 98+24.66 – This cross section crosses U.S. 15 and parallels Buffalo Creek. The cross section is not perpendicular to the direction of flow of floodwaters.

Floodway encroachment cards were added for sections 39.5, 40.05, 41.47, 41.48, 41.92, and 41.93 between the railroad and Route 15. The floodway dimensions were scaled from the FEMA Flood Boundary and Floodway Map.

Proposed Conditions Model – The Proposed Conditions model is identical to the Adjusted Existing Conditions Model except the existing bridge has been replaced with the proposed bridge at Third Street / Route 15. Cross-sections 41.48 and 41.92 just upstream and downstream of the existing bridge have been replaced with cross-sections 41.39 and 41.96 just upstream and downstream of the proposed bridge.

The proposed layout of the bridge analyzed in this study is included in Exhibit 6. VDOT is preparing preliminary plans for replacing the existing seven span bridge with a 272’ 4” long, three span bridge. The bridge has 1:1 sloping abutments, spans of 88’8”, 95’0”, and 88’8”, and solid, round nose piers with a width of 2’6”. The Normal Bridge Method was used to model the existing and proposed bridges.